Stable isotope characterization to evaluate the efficiency of induced denitrification at field-scale

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NO_3^- pollution is currently worrying as it has been related to ecological and human health problems. Denitrification reaction is one of the most effective process to remove NO_3^- pollution from groundwater. However electron donor availability (organic C or reduced S compounds) is usually a limiting factor to achieve field-scale NO_3^- attenuation. Strategies aiming to fill the lack of electron donors have gained attention. Laboratory [1], [2] and small scale pilot sites [3] have already demonstrated that adding an electron donnor is adequate to induce nitrate attenuation in groundwater. Field scale isotopic studies are a useful tool to trace NO_3^- sources and transformation processes. The isotopic fractionation of ^{15}N and ^{18}O during denitrification allows to estimate its efficacy tracing induced attenuation. The present study aims to evaluate the convenience of using stable isotopes of ^{15}N and ^{18}O from NO_3^- to trace denitrification efficiency in the course of a large-scale induced groundwater bioremediation project.

The pilot plant consisted of 2 injection, 3 monitoring and 1 extraction wells. Acetic acid was selected to stimulate and sustain intrinsic heterotrophic denitrifiying bacterial activity. A total of 42 samples were collected within 10 field campaigns from June 2015 to October 2016 and analysed for chemical and isotopic characterization. Batch microcosms experiments simulating aquifer conditions (sediment and groundwater from pilot plant) were inoculated with acetic acid to induce denitrification. Laboratory determined ε values were -12.6‰ for N and -13.3‰ for O. The isotopic fractionation obtained were applied to evaluate the pilot plant performance in relation to its NO_3^- attenuation capacity

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[2] Torrentó et al. (2011) *Chemical Geology* 287, 90–101.

[3] Vidal-Gavilan et al. (2013) *Appied. Geochemistry* 32, 153–163.